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# U. S. Naval School of Aviation Medicine



U. S. NAVAL AIR STATION  
PENSACOLA, FLORIDA

## RESEARCH REPORT



THE EFFECTS OF AUDITORY-VESTIBULAR NERVE PATHOLOGY  
ON THE ADJUSTIVE EYE-ROLLING REFLEX

PROJECT NO. NM 001 063.01.32

U. S. NAVAL SCHOOL OF AVIATION MEDICINE  
NAVAL AIR STATION  
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JOINT PROJECT REPORT NO. 32

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Office of Naval Research, Project Designation No. NR 143-455  
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U. S. Naval School of Aviation Medicine

The Bureau of Medicine and Surgery  
Project No. NM 001 063.01.32

THE EFFECTS OF AUDITORY-VESTIBULAR NERVE PATHOLOGY  
ON THE ADJUSTIVE EYE-ROLLING REFLEX

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## SUMMARY

1. The method of measuring the counter-rolling reflex by the use of after-images was applied to a patient with VIII nerve pathology.
2. Virtual absence of adjustive eye-rolling to lateral body tilts in the right quadrant, and minimal values to tilting in the left quadrant were found for the patient.
3. The results support the contention that normal adjustive eye-rolling is dependent upon the functional integrity of the vestibular system.

## INTRODUCTION

In a patient with VIII nerve pathology, Mann (1) found reduced precision of judgment of both visual and postural verticality. The errors made by this patient when judging the visual vertical were consistently in the quadrant opposite to that in which he was tilted, and his errors increased as the body inclination increased up to  $30^{\circ}$ .

The present study used the same patient, and was designed to measure:  
(a) the amount of adjustive eye-rolling with various degrees of body tilt,  
(b) possible differential sensitivity of right and left vestibular function as indicated by this reflex.

The patient's medical history and diagnosis, reported in detail by Mann (1), is based on medical information supplied by the patient's physician. Supplementary data from further sensory tests made by Mann in the Tulane Psychological Laboratory are available (1).

The medical diagnoses were: (a) Meningitis, acute, due to mycobacterium tuberculosis, with partial palsy of the abducens nerve; (b) paralysis of VIII cranial nerve, auditory and vestibular branches, secondary to streptomycin therapy. It was suggested that the patient's right vestibular system may be impaired to a lesser extent than the left (1).

The patient came to the laboratory during the twelfth and thirteenth months after the beginning of therapy. He was cooperative in all tests, and had no apparent difficulty in following directions and reporting his observations. He had made considerable compensation for his VIII nerve paralysis. He walked quite easily and comfortably with eyes open, but with eyes closed, he was unable to balance on one leg, and was able to take only two or three steps before falling (1, pp. 450-451).

## PROCEDURE

The method used in the present study has been previously reported in detail by McCord (2). The patient was seated in a tilt chair in a light-tight room. The experimenter presented a vertical slit of fairly intense

light to the patient, who was required to fixate it binocularly in order to produce an after-image. After the patient was exposed to this stimulus light, he was tilted to a predetermined inclination in the lateral tilting chair and then required to align an adjustable luminous line of low intensity with the after-image.

## RESULTS

The results indicated in Table I represent the Mean Constant Errors obtained in a previous study (2) from six normal subjects at  $0^{\circ}$ ,  $10^{\circ}$  and  $45^{\circ}$  body tilt and in the present experiment from the patient for right and left body tilts ranging from  $0^{\circ}$  to  $90^{\circ}$ . With the normal subjects, there was no difference between right and left body tilt, and so the data for these subjects is presented in Table I irrespective of the direction of body tilt.

The most striking finding in the present experiment was the lack of evidence for adjustive eye-rolling in the patient. The low Mean Constant Errors yielded by the patient with either left or right body tilts cannot be said to differ significantly from zero. There is, then, little or no evidence for either counter-rolling or pro-rolling eye reflexes in the patient. The measures obtained do not indicate, with any degree of certainty, a differential sensitivity in right and left vestibular function. Because the same measurement method was apparently sufficient to demonstrate adjustive eye-rolling which varied systematically with the angle of body tilt in the normal subjects, it seems likely that the VIII nerve paralysis is responsible for the failure of the patient to yield data indicative of adjustive eye-rolling.

In view of Mann's previous finding (1) of pronounced Aubert-type responses in the same patient, it is apparent that the counter-rolling eye reflexes are not a necessary condition for the Aubert effect, i.e., counter-tilting of the visual vertical as a result of body tilt. Since Mann reports slightly greater mean errors (Aubert effect) with the patient than are found in some normals (3), it might be inferred that the counter-rolling reflex serves to reduce the Aubert effect, and that the lack of a counter-rolling reflex (as in the patient) or the presence of a pro-rolling reflex serves to increase the Aubert effect. Further experimental investigation of these inferences is highly desirable.

Table I

Direction and magnitude of adjustive eye-rolling in one case of VIII nerve pathology compared with that of intact subjects.\* Eye-rolling measures are expressed in degrees from the position of body tilt.

Body Tilt	Intact Subjects	Patient (VIII nerve)	
		Left Tilt	Right Tilt
0°	0.920	0.012	0.012
10°	-0.870	0.000	0.039
30°		0.024	0.000
45°	-4.670	0.032	0.000
60°		0.090	0.000
90°		-0.090	0.000

\*Each value for the six intact subjects is based upon sixty readings. Standard deviations for these values are given in a previous paper (2). For the patient, the mean values up to and including body tilt of 45° are based upon five readings. The values at 60° and 90° each represent a single reading.

#### REFERENCES

1. Mann, C. W. The effects of auditory-vestibular nerve pathology on space perception. J. exp. Psychol., 1951, 42, 450-456.
2. McCord, W. F. The measurement of rotatory eye movements (counter-rolling reflex). U. S. Naval School of Aviation Medicine and Tulane University, Project No. NM 001 063.01.31, Joint Project Report No. 31, 1 June 1953.
3. Jones, D. B. Judgment of the visual horizontal and vertical when in positions of lateral body tilt. Unpublished master's thesis, Tulane University, 1950.